

Amendments to the Drawings

Please find five pages of formal drawings attached to Appendix A of this paper.
No new matter was entered in replacing the drawings.

REMARKS

1. The Application was filed with 52 claims, of which all are restricted except Claims 1, 4, 10-20, 22-36 and 38-42. Claim 37 has now also been restricted, and has been marked as "withdrawn" in the above listing of claims.

2. Applicants have prepared new drawings per the Examiner's objections. Five pages of the drawings are attached at Appendix A. No new matter was entered in preparing the formal drawings.

3. Claims 1 and 10 have been amended to make it clear that Applicants refer to a refractive index change in which $\Delta n = 0.5$. Support for the amendments is found at least in the specification, paragraph [0007] which mentions that a refractive index change is one in which Δn is changed, and paragraphs [0018] and [0019], which state that the refractive index change is at least 0.5.

Claims 1, 4, 10-20, 22-36, and 38-42 have been amended to refer to the invention as a light transforming device, rather than a light transmitting device. This amendment has been made to clarify the claims, rather than for any reason relating to prior art or to the patent statute. Support for the amendment is found at least in paragraph [0046] and [0052] as filed, which refer to the function of the layered structure of embodiments of the present invention as structures for achieving light beam transformation.

4. Paragraph [0052] has also been amended to correct a typographical error.

5. Claims 1, 4, 10-20, 22, 28-36, and 38 are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Pat. No. 4,640,585, to Hidetoshi Nojiri ("Nojiri"), in view of U.S. Pat. No. 4,859,492 to Harvey Rogers et al. ("Rogers"). The rejection states that Nojiri discloses all the limitations of at least independent Claims 1, 10, and 28, except that the Δn of the two materials is at least 0.5. The rejection also states that Rogers discloses this limitation.

Applicants traverse the rejection. The rejection states that Nojiri is desirably combined with Rogers in order "to achieve the product as claimed by the Applicant." See Office Action, p. 7, lines 9-12. This suggests that these specific references were combined using forbidden hindsight.

Nojiri is directed to semiconductor thin film lenses, while Rogers is directed to lens coatings. There are other important differences. For instance, Rogers teaches film thicknesses of silicone and lead silicate of 1080 Å and 2700 Å, see Table 1 in col. 7 of Rogers, while Nojiri teaches film thickness of gallium arsenide and gallium aluminum arsenide of 30 Å and 100 Å, see Table 1 in col. 2 of Nojiri.

The stated motivation in the Office Action for combining Nojiri with Rogers is that the combination provides environmental stability against moisture. Office Action, p. 7, lines 12-14. Considering the differences in the teachings of Rogers and Nojiri, providing environmental stability against moisture is clearly an insufficient motivation for a complete change of materials and at least a 10-fold difference in thicknesses. It appears that the actual motivation for combination is, as stated in the rejection, "to achieve the product as claimed by the Applicant," i.e. hindsight. Thus, combining the layers of Rogers with the structure of Nojiri would result in alternating layers of silicone and lead silicate, respectively 1080 Å and 2700 Å thick, rather than the much thinner transforming layers of the present invention. The Office Action notes that Rogers teaches no transformation, which is contrary to Nojiri and to the present invention. Office Action, p. 7, lines 3-4. Even with hindsight, however, Rogers and Nojiri do not teach all the limitations of the inventions recited in the claims.

Nojiri and Rogers do not teach a device in which Δn is at least 0.5

Rogers does not teach or suggest a layering of materials in which the Δn of the two materials is at least 0.5. As noted in the rejection, Rogers teaches a layering of two materials, the two materials having different refractive indices. One material taught is SiO₂, with a refractive index of 1.46. Rogers, col. 5, lines 29-31. The second material is preferably lead silicate, PbO/SiO₂, with a refractive index of 1.65 to 1.71. See Rogers, cols. 5-6. While other materials having a higher refractive index may be used, such as

TiO₂ or TaO₅, the preferred material is lead silicate. As seen from these values, the Δn between silicon dioxide and lead silicate is about 0.2.

The passages in cols. 5-6 describe a preferred second material as being lead silicate. Even if the passage at col. 6, lines 1-5, is interpreted to mean that the second material may be TiO₂ or TaO₅, which have higher indices of refraction, Rogers teaches a second layer in which the Δn of the two materials is as little as 0.2, which is far different from the $\Delta n = \text{at least } 0.5$ as claimed. Accordingly, at least this limitation of Claims 1 and 10 is not taught or suggested in Nojiri and Rogers.

Nojiri and Rogers do not teach a device in which the layers are amorphous materials

Nojiri teaches alternating layers of GaAs with Ga_{0.7}Al_{0.3}As layers, and states specifically that these layers are formed by growing thin film crystals. Col. 3, lines 6-64. Accordingly, these layers are crystalline, not amorphous as required by Claim 28. If TiO₂ (anatase or rutile) or TaO₅ (rhombic) are used as the second material, it will be recognized that these are also crystalline materials, not amorphous. Rogers' preferred material, lead silicate, alternating with layers of SiO₂, is glassy and thus amorphous, but the layers then have only a Δn of about 0.2, rather than the required 0.5. The Office Action admits that most metal and ceramic materials used in semiconductor wafer production are polycrystalline and contain microscopic crystalline grains. Office Action, p. 6, lines 18-21. Accordingly, the references teach materials that are crystalline, not amorphous, as required by Claim 28. Claim 28 and dependent claims 29-42 are therefore allowable. The Examiner is respectfully requested to withdraw the rejections of Claims 28-42 and to allow the claims.

Claims 14 and 32 are not "Product by Process" Claims

A "product by process" claim is a claim in which there is a lack of physical description of a product. M.P.E.P. 2113 at 2100-62. The case cited in the Office Action as appearing in M.P.E.P. 2113 specifically refers to a claim which recites only process limitations. Office Action, p. 8, lines 1-5 in cited passage.

In Claims 14 and 32, the product is claimed as one in which thickness of each layer is controlled to within 0.5 nm and the effective index of refraction is controlled to within 0.005. No process steps are recited in the claims. The resulting light transmitting device is thus one in which each layer is controlled to a thickness within 0.5 nm (i.e., ± 0.5 nm) and in which the effective index of refraction is controlled to within 0.005 (i.e., ± 0.005).

Applicants submit that Claims 14 and 32 are not "product by process" claims and that these claims are not obvious in view of Nojiri and Rogers. The rejection cites no passage in Nojiri or Rogers as teaching or suggesting these limitations. The rejection of Claims 14 and 32 is improper and should be withdrawn.

Accordingly, the Office Action does not make out a prima facie case of obviousness against cited Claims 1, 4, 10-20, 22, 28-36, and 38. There is insufficient motivation to combine the references, and even the combined references do not teach or suggest all the limitations of the claims. The Examiner is respectfully requested to withdraw the rejection of claims over Nojiri in view of Rogers.

6. Claims 23-27 and 39-42 are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Pat. No. 4,640,585, to Hidetoshi Nojiri ("Nojiri"), in view of U.S. Pat. No. 4,859,492 to Harvey Rogers et al. ("Rogers"), and further in view of U.S. Pat. No. 6,229,947 to Gregory Vawter ("Vawter") and U.S. Pat. No. 6,345,138 to Kiyoyuki Kawai et al. ("Kawai"). The rejection states that Nojiri and Rogers disclose the material discussed above in the rejections of other claims, and admits that they do not disclose the limitations of Claims 23-27 and 39-42. The rejection then states that Vawter and Kawai disclose the limitations of Claims 23-27 and 39-42.

The fact that the references can be combined does not provide sufficient motivation for making the combination. The stated motivation in the Office Action is for transforming a planar wave to an elliptical one. Office Action, p. 9, lines 12-14. Applicants do not understand how the motivation arises, since Nojiri discusses the difficulty of coupling an elliptical beam, and Vawter adds a monolithic structure to assist the coupling because of losses when coupling elliptical beams. Nojiri, col. 1, lines 12-

18; Vawter, col. 1, lines 30-40. The references contradict the stated motivation for combining because one would not be motivated to transform planar waves into difficult-to-transform elliptical beams.

In any event, the Office Action does not specifically cite passages of Kawai or Vawter against particular limitations of any of Claims 23-27 and 39-42. Furthermore, "etching the planar waveguide into rib waveguides," is a teaching of Vawter, and is not one of the present claim limitations. Office Action, p. 8, lines 22-23. Accordingly, the Office Action does not make out a prima facie rejection of Claims 23-27 and 39-42.

In addition, Claims 23-27 and 39-42 are allowable at least because they depend from allowable Claims 10 and 28, because Nojiri and Rogers do not teach all the limitations of at least Claims 10 and 28. The rejection of Claims 23-27 and 39-42 is therefore improper. The Examiner is respectfully requested to withdraw the rejections.

7. The Examiner is asked to withdraw the rejections and to allow the claims of the application. The Examiner is respectfully requested to call the undersigned if the call would help expedite the case or would be helpful to the Examiner.

Respectfully submitted,

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APPENDIX A